Special Issue Honouring Helias A. Udo de Haes: Columns

Emergence and Future of Life Cycle Impact Assessment: Good science comes from good people

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DOI: http://dx.doi.org/10.1065/lca2006.04.004

Life Cycle Impact assessment (LCIA) is a young field of research. This column provides in short a personal point of view on some achievements of the last decades in LCIA and discusses how to address future challenges.

How has the field of Life Cycle Impact Assessment emerged and progressed in the last decades?

The field of Life Cycle Impact Assessment has emerged from the conjunction of three main factors:

- First, the increasing need for better environmental information for decision making in product manufacturing, use and disposal.
- Second, the development of environmental sciences that provided new knowledge and models, identifying the mechanisms behind environmental problems.
- Third, a group of pioneers, individuals coming from very different horizons, but with a common vision and sense of urgency. They perceived the need to bridge the huge gap between decision making and environmental science, to understand and assess how decision on products affects emissions and eventually the environment.

The 'bridge' LCIA structure has deeply evolved in two decades. The first idea was to group emissions according to the air, water and soil compartments and to use data from environmental legislation to weight these emissions. This was either in term of emission flows as proposed by Mueller-Wenk (1978) in the seventies or in term of concentration limits leading to critical volumes. The CML team at Leiden University played a very significant role in structuring the field in term of safeguard subjects and impact categories (Heijungs et al. 1992). Under the leadership of Helias Udo de Haes, successive SETAC working groups on impact assessment realized the need to follow cause-effect chains and to borrow multimedia fate and exposure models (or dose-response) from various fields (Udo de Haes et al. 2002). Inspired by the EPS framework (Steen 1999), damage approaches, such as Ecoindicator 99 (Goedkoop et al. 2000), created the operational basis for the SETAC-UNEP framework combining midpoint with damage categories (Jolliet et al. 2003).

What is the present state of LCIA?

We presently see several signs of maturity in LCIA. For example, in the field of toxicity, LCIA is fully part of a collaborative effort in which scientists from multimedia model, risk assessment, indoor air pollution and LCIA have for example defined the concept of intake fraction (Bennet et al. 2002). Some concepts adapted from risk assessment to the comparative LCIA framework are bringing innovative developments back for comparative risks. Thanks to the effort of colleagues who saw the importance of vehicles for scientific communications, the International Journal of LCA, the Journal of Industrial Ecology and the Journal of Cleaner Production are now in the Science Citation Index. Life Cycle approaches and LCIA are also published in the best environmental journals such as Environmental Science and Technology.

In which direction to further develop LCIA?

At the same time, we still have huge challenges in front of us. Further frameworks are needed to address not only the typical impacts of OECD, but also the unsustainable use of land leading to salinisation, erosion and deforestation. The overconsumption of water is crucial worldwide. Work environments and indoor environments matter because this is where human health damages are obvious and observable. There is also a clear need to consolidate this young science: progresses made in the assessment of toxic organic substances need to be extended to metals taking into account speciation. The latest models on acidification and eutrophication impacts should account for ecosystem dose-response, while providing operational coefficients. Human health assessment should make use of recent toxicokinetic models. Are we inevitably moving towards always having more complex tools and models? Not necessarily. We do not automatically need more complex, but more reliable and more relevant meth-

ods. My own vision of how to deal with complex systems can be summarized in the 'KICS' watchword: 'Keep It Cleverly Simple'. Detailed and site specific models – like the spatial versions of IMPACT 2002 or EDIP 2003 – are, before all, useful in helping to find clever solutions on simpler, but accurate, corrections to keep the LCI and LCIA tool fully operational. We need to focus on what really matters as well as sound interpretation accounting for uncertainties and knowledge limitations. This also advocates pursuing the efforts on both midpoint and damage modeling to understand how much the different impact categories matter in different parts of the world.

How can we stimulate further LCIA development in the most efficient way?

Up to now, our field has developed because of the impulses given by individuals or teams of individuals. New scientists will bring fresh ideas. To promote this, we need to systematically give a chance and a priority to young scientists, for example, when selecting platform presentations in congresses instead of sticking to confirmed researchers. It is important we encourage new actors to join with new perspectives. It is very interesting to see emerging countries, like Australia and Canada, which have been recently organized with very high quality and have well attended symposiums with huge industrial interests. I strongly urge our colleagues from these countries to publish and enrich the research diversity with their contributions.

In addition, let us encourage competition to produce new ideas. I am pleased to see in several areas different teams emulating each other. This emulation is sound. At the same time, our field requires strong collaboration and effort coordination to consolidate and bring the best ideas and teams in synergy towards practical guidance to LCA users. This is one of the top priorities of the LCIA work in the Life Cycle Initiative.

How better to summarize these perspectives than to look at the career and actions of our colleague and friend, Helias Udo de Haes?

His pioneer actions have paved the way for the recognition of this young scientific discipline in multiple ways:

– A special emphasis in his career has been put on building bridges between disciplines systematically promoting interactions between various tools and specialists.

– His actions are grounded in a rare combination between rigor and the ability to identify at once the key issues of a problem, together with a broad mind. This is combined with a very high sense of ethic and respect for pairs. This is not only for established scientists, but also for young scientists, being always interested to be stimulated by newcomers and innovative contributors. He has played a very strong role in education, supervising numerous PhD students in various fields of industrial ecology and advising young scientists from different institutions worldwide.

– Since the early 1990s, he has played a very prominent international role in leading the effort – first in the development of the Life Cycle Impact Assessment methodology within SETAC, then in the elaboration of ISO standards. He then brought the active involvement of UNEP – the United Nation Environmental Programme – by initiating the Life Cycle Initiative and becoming its first scientific director: I will always remember our first meeting with Jacqueline Aloisi de Larderel – the former director of the UNEP Division of Technology, Industry, and Economics – only a week after having contacted her. Our need to involve UNEP in LCIA guidance was precisely meeting the pledge of the UN general secretary for methods to support the development of more sustainable products. This international effort has only been made possible through Helias' vision, will and perseverance, always finding innovative solutions to meet the needs of both scientists and practitioners.

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Received: January 3rd, 2006
Accepted: February 21st, 2006
OnlineFirst: February 22nd, 2006